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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-120912
(43)Date of publication of application : 28.04.2000

(51)Int.Cl. F16K 31/06
F04B 27/14
F04B 49/06

(21)Application number : 10-295492
(22)Date of filing : 16.10.1998

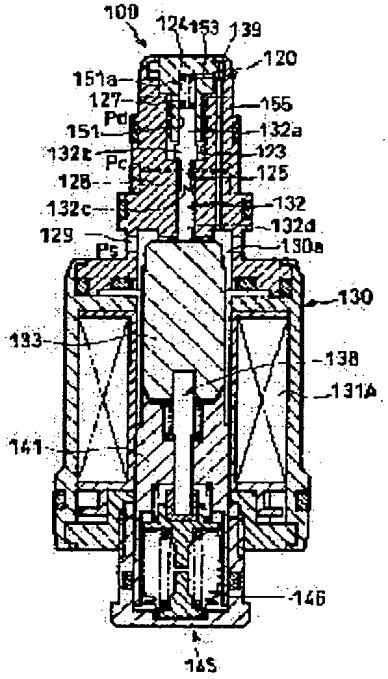
(71)Applicant : FUJI KOKI CORP
ZEXEL CORP
(72)Inventor : KUME YOSHIYUKI
IMAI MASAYUKI
KAZAHAYA YUKIO

(54) CONTROL VALVE FOR VARIABLE DISPLACEMENT COMPRESSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To eliminate bad influence of a pressure change of refrigerant gas exerted on an operation of a valve element so as to improve opening precision of the valve element by communicating a plunger chamber in a solenoid excitation part with a pressure chamber and inserting upper and lower end parts of the valve element constructed of a rod type body forming a control valve main unit into both chambers.

SOLUTION: This control valve 100 is constructed of a solenoid excitation part 130 provided with a plunger 133 moving upward/downward according to excitation of a solenoid 131A, a pressure sensing part 145 having a bellows 146 interlocking with the plunger 133, and a control valve main unit 120 having a valve chamber 123, a valve element 132 interlocking with the plunger 133 and the like. A pressure chamber 151 in a stopper 124 is communicated with a clearance part 139 via a lateral hole 153, while the clearance part 139 is communicated with the plunger chamber 130a via a cancel hole 155. In this way, a pressure in the plunger chamber 130a in the control valve main unit 120 and a pressure of the pressure chamber 141 serve as an intake pressure together, so that pressure in the upper and lower ends in the moving direction of the valve element 132 are always equalized to each other.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] The solenoid excitation section arranged in the center section. The control valve main part arranged to the unilateral of this solenoid excitation section. The pressure-sensitive part arranged to the side else. It is the control valve for variable-capacity type compressors equipped with the above. the aforementioned control valve main part The valve chest which has a valve port on a base, and the valve element of the rod-like structure which is arranged in this valve chest and carries out an opening-and-closing operation with the plunger of the aforementioned solenoid excitation section, While having the pressure room arranged above the aforementioned valve chest, opening the plunger room and the aforementioned pressure room of the aforementioned solenoid excitation section for free passage and the aforementioned valve element's inserting the up edge in the aforementioned pressure room, it is characterized by inserting a lower edge in a plunger room.
[Claim 2] The aforementioned control valve main part is a control valve for variable-capacity type compressors according to claim 1 characterized by having the **** refrigerant port which is open for free passage to the aforementioned valve chest, the crank case refrigerant port which is open for free passage to the aforementioned valve port, and the inhalation refrigerant port which is open for free passage in the aforementioned plunger room.
[Claim 3] The aforementioned pressure room is formed in the stopper arranged in the upper part of the aforementioned valve chest. the aforementioned valve element The aforementioned expansion valve element section by the rod-like structure which consists of the upper part, the expansion valve element section, a thin diameter section, and the lower part in the aforementioned valve chest The control valve for variable-capacity type compressors according to claim 1 or 2 which arranges the aforementioned thin diameter section in the aforementioned valve port, carries out fitting support of the aforementioned upper part at the aforementioned stopper, and is characterized by carrying out fitting support of the aforementioned lower part at the aforementioned control valve main part.
[Claim 4] The upper part, the lower part, and the aforementioned valve port of the aforementioned valve element are a control valve for variable-capacity type compressors given in the claim 1 characterized by making the cross section equal, or any 1 term of 3.
[Claim 5] the cancellation which the valve-closing spring which energizes the aforementioned valve element to the aforementioned valve chest side has been arranged in the aforementioned pressure interior of a room, and drilled the aforementioned pressure room and the aforementioned plunger room in the aforementioned control valve main part — the control valve for variable-capacity type compressors given in the claim 1 characterized by being open for free passage through a hole, or any 1 term of 3

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the control valve for variable-capacity type compressors used for air conditioners, such as vehicles, and relates to the control valve for variable-capacity type compressors which accepts the need and controls supply of the refrigerant gas in a crank case from a discharge-pressure field especially.
[0002]
[Description of the Prior Art] It is used in order that the variable-capacity type compressor equipped with the cylinder, the piston, the cam plate, etc. may compress and carry out the regurgitation of the refrigerant gas of the conditioner for automobiles from the former, and what was constituted so that the degree of tilt angle of a cam plate might be changed and discharging volume might be changed is known by equipping this variable-capacity type compressor with the refrigerant gas passageway which opens a discharge-pressure field and a crank case for free passage, and adjusting the pressure in the aforementioned crank case. Pressure regulation in a crank case is performed by opening adjustment of the control valve prepared in the middle of the refrigerant gas passageway by supplying a high-pressure compression refrigerant gas to the aforementioned crank case from the aforementioned discharge-pressure field.
[0003] As such a control valve, there is control valve 100' for variable-capacity type compressors (henceforth a "control valve") as shown in drawing 6 and drawing 7 , for example (refer to JP,9-268973,A). This control valve 100' is prepared in the rear housing 210 side of the variable-capacity type compressor 200, and performs pressure regulation of the crank case 231 in the front housing 230 it is connected [front / cylinder block / of the variable-capacity type compressor 200 / 220].
[0004] The cam plate slack cam plate 240 is supported possible [a slide and ****] in the direction of an axis of the drive shaft 250, and the guide pin 241 of a cam plate 240 is supported free [a slide on the support arm 252 of the rotation base material 251] by the crank case 231 interior. Moreover, the cam plate 240 is connected with the piston 260 arranged free [sliding] in a cylinder bore 221 through the shoe 242 of the couple of this cam plate 240.
[0005] According to the difference of the suction pressure Ps in a cylinder bore 221, and the crank case pressure Pc in a crank case 231, the aforementioned cam plate 240 rotates in the direction of an arrow, and changes the degree of tilt angle. It is based on this degree of tilt angle, and the stroke width of the longitudinal slide movement in the cylinder bore 221 of a piston 260 is determined. and the interception object 270 which contacts the mountain side section of a cam plate 240 with rotation of the direction of an arrow of a cam plate 240 — hold — longitudinal slide movement of the inside of a hole 222 is carried out
[0006] When partition formation of the regurgitation rooms 212a and 212b which constitute Inhalatoriums 211a and 211b and the discharge-pressure field which constitute an inlet-pressure field is carried out and a piston 260 carries out longitudinal slide movement to the rear housing 210 based on rotation of the aforementioned cam plate 240, after the refrigerant gas in inhalatorium 211a is inhaled in a cylinder bore 221 from the inhalation port 213 and is compressed into a predetermined pressure, it is breathed out by regurgitation room 212a from

the regurgitation port 214.
[0007] furthermore, the inhalation path 215 formed in a part for the core of the rear housing 210 — the aforementioned hold — while it is open for free passage to a hole 222, it is open for free passage to the aforementioned inhalatorium 211b through a through-hole 216 Here, if a cam plate 240 moves to the interception object 270 side, this interception object 270 will move to the aforementioned inhalation path 215 side, and will close a through-hole 216. The upper part side of the inhalation path 215 and control valve 100' is opened for free passage by th pressure-taking path 217 which draws suction pressure Ps in control valve 100', and regurgitation room 212b and a crank case 231 are opened for free passage through the air-supply path 218,219 of control valve 100', and this air-supply path 218,219 is opened and closed by valve element 106of control valve 100' '.
[0008] Through the air-supply path 218, the crank case internal pressure Pc is led to the air-supply path 219 through valve port port 114', and suction pressure Ps is led to valve chest port 113' for the discharge pressure Pd of regurgitation room 212b through the pressure-taking path 217 at inlet-pressure introduction port 115'. When the detection temperature of the indoor sensor 281 is more than the setting temperature of the room temperature setter 282 when the operation switch 280 of an air conditioner is ON for example, it is ordered excitation of solenoid 101' of control valve 100', predetermined current is supplied to solenoid 101' through the drive circuit 284, and movable iron core 102' can draw a control computer 283 near to a fixed iron core 104' side according to the suction force of this solenoid 101', and the energization force of spring 103'.
[0009] Valve element 106' attached in solenoid rod 105' moves the opening of valve port 108' to the side which decreases with movement of movable iron core 102', resisting the energization force of compulsive opening spring 107'. With this movement, valve element 106' and pressure-sensitive rod 109' of one also go up, and bellows 111' connected free [attachment and detachment] is forced through pressure-sensitive rod receptacle section 110'.
[0010] This bellows 111' is displaced according to change of the suction pressure Ps introduced in pressure-sensitive part 112' through the pressure-taking path 217, and gives a load to aforementioned pressure-sensitive rod 109'. That is, control valve 100' determines the degree of valve-opening of valve port 108' by valve element 106' by balance with the suction force by aforementioned solenoid 101', the energization force of aforementioned bellows 111', the energization force of aforementioned forcible opening spring 107', etc.
[0011] When large (a cooling load is large) as mentioned above, the difference of the detection temperature of the indoor sensor 281 and the setting temperature of the room temperature setter 282 is attracted by the increase in current value, movable iron core 102' is attracted by fixed iron core 104', the increase of the force which decreases the opening of valve port 108' of valve element 106', and control valve 100' operate so that the low suction pressure Ps may be held more, and opening and closing of aforementioned valve element 106' are performed by this pressure.
[0012] If the degree of valve-opening becomes small, since the refrigerant capacity which flows from regurgitation room 212b to a crank case 231 through the air-supply path 218,219 will decrease and the gas of a crank case 231 will flow into Inhalatoriums 211a and 211b simultaneously, the crank case internal pressure Pc becomes low. And when a cooling load is large, the suction pressure Ps in the aforementioned cylinder bore 221 is high, and produces a difference in this suction pressure Ps and the aforementioned crank case internal pressure Pc, the degree of tilt angle of the aforementioned cam plate 240 is large, by the bird clapper, the aforementioned interception object 270 separates from the aforementioned inhalation path 215 side, and a path 216 is opened.
[0013] furthermore, when the heat-exchange capacity of the condenser in a refrigerating cycle falls remarkably and the maximum discharging volume operation of a compressor is performed, such as at for example, the time of traffic congestion of midsummer etc., aforementioned control valve 100' While a discharge pressure Pd becomes very high, the crank case internal pressure Pc serves as a value near suction pressure Ps. In order that valve lement 106' may be strongly forced to a valve seat by the pressure differential of these discharge pressures Pd and the crank

case internal pressure Pc and opening of an air-supply path may prevent a bird clapper etc. difficult by it, The vertical edge of valve element 106' is equipped with solenoid rod 105' and pressure-sensitive rod 109'. When the path of solenoid rod 105' is made equal to the path of valve port 108' and valve element 106' closes valve port 108', it is made for the pressure-receiving area of the movable direction both sides of valve element 106' to become almost equal. The crank case internal pressure Pc is introduced into valve port 108' through the air-supply path 219 and port 114'. And while this pressure Pc is drawn in solenoid room 117' through areole 118', run through-hole 119', free passage slot 120', etc. and making it the pressure of this solenoid room 117' and the pressure of aforementioned valve port 108' become the same By lessening influence of pressure-sensitive rod narrow diameter portion 110' as much as possible, and making the cross section of pressure-sensitive rod 109' smaller than the effective-area product of valve port 108' by making small the cross section of pressure-sensitive rod 109' itself Reduction of the influence of a pressure which acts on solenoid rod 105', valve element 106', and pressure-sensitive rod 109' is aimed at, and it is made for the pressure produced on movable direction both sides of valve element 106' to become equal. Moreover, aforementioned solenoid rod 105', valve element 106', and pressure-sensitive rod 109' are formed in one, and the above-mentioned cancellation mechanism is constituted.

[0014]

[Problem(s) to be Solved by the Invention] by the way, in conventional control valve 100' mentioned above As shown in drawing 6 and drawing 7 , valve chest 116' was prepared in the center of a control valve main part, the pressure-sensitive part is prepared in the bottom, and solenoid room 117' is prepared in the valve chest bottom. as a cancellation mechanism While the crank case internal pressure Pc of a medium voltage is led to valve port 108' and solenoid room 117' which were prepared in the vertical edge of valve chest 116', the high-pressure discharge pressure Pd is led to valve chest port 113' through the air-supply path 218. Although it is adjusting about the pressure-receiving area which is the movable direction bottom of valve element 106', and receives the crank case internal pressure Pc so that each pressure-receiving area of valve port 108' and solenoid rod 105' may not be pressure influenced, since suction pressure Ps and the crank case internal pressure Pc are not in the always same pressure state, the cancellation rate will not be fixed and cannot say that it is canceled completely.

[0015] Moreover, since the pressure fluctuation difference by operation of a compressor is large, if this pressure fluctuation arises, the force of acting on valve element 106' will also be changed, and a problem that it has a bad influence on the opening-and-closing precision of valve element 106' produces the pressure in a crank case. It is offering the control valve for variable-capacity type compressors which this invention's is made in view of such a trouble, and the place made into the purpose loses the bad influence by the refrigerant gas pressure which acts on the valve element of a control valve, and raises valve-opening close precision.

[0016]

[Means for Solving the Problem] The control valve for variable-capacity type compressors concerning this invention that the aforementioned purpose should be attained In the control valve for variable-capacity type compressors equipped with the solenoid excitation section arranged in the center section, the control valve main part arranged to the unilateral of this solenoid excitation section, and the pressure-sensitive part arranged to the side else The valve element of the rod-like structure which the aforementioned control valve main part is arranged in the valve chest which has a valve port on a base, and this valve chest, and carries out an opening-and-closing operation with the plunger of the aforementioned solenoid excitation section, While having the pressure room arranged above the aforementioned valve chest, opening the plunger room and the aforementioned pressure room of the aforementioned solenoid excitation section for free passage and the aforementioned valve element's inserting the up edge in th aforementioned pressure room, it is characterized by inserting a lower edge in a plunger room.

[0017] Moreover, the aforementioned control valve main part is characterized by having the **** refrigerant port which is open for free passage to the aforementioned valve chest, the crank case refrigerant port which is open for free passage to the aforementioned valve port, and the

inhalation refrigerant port which is open for free passage in the aforementioned plunger room. Furthermore, the aforementioned pressure room forms in the stopper arranged in the upper part of the aforementioned valve chest, and the aforementioned valve element is the rod-like structure which consists of the upper part, the expansion valve element section, a thin diameter section, and the lower part, and the aforementioned expansion valve element section arranges in the aforementioned valve chest, the aforementioned thin diameter section arranges in the aforementioned valve port, fitting support carries out to the aforementioned stopper in the aforementioned upper part, and it is carrying out having carried out fitting support to the aforementioned control valve main part in the aforementioned lower part as the feature.
[0018] the cancellation which it was characterized by the upper part, the lower part, and the aforementioned valve port of the aforementioned valve element making the cross section equal, and the valve-closing spring which energizes the aforementioned valve element to the aforementioned valve chest side has been arranged in the aforementioned pressure interior of a room, and drilled the aforementioned pressure room and the aforementioned plunger room in the aforementioned control valve main part further again — it is characterized by to be open for free passage through a hole The control valve for variable-capacity type compressors concerning this invention constituted like the above the refrigerant gas of the suction pressure Ps of the plunger interior of a room — cancellation — a valve element, since it is led to a pressure room through a hole Moreover, the aforementioned suction pressure Ps will be received from lower both sides. Since the vertical section of the aforementioned valve element is made into the same cross section, it becomes impossible to influence the aforementioned valve element of the aforementioned discharge pressure Pd, it can always maintain balance in the valve element upper and lower sides, and the opening-and-closing precision of a valve can be raised. moreover, the cancellation mechanism of the control valve concerning this invention — a stopper, the opening section, and cancellation — since it consists of a hole etc. and is arranged in the control valve main part, as compared with the former, composition becomes easy, and curtailment of part mark and reduction of a manufacturing cost can be aimed at
[0019]
[Embodiments of the Invention] Hereafter, 1 operation form of the control valve for variable-capacity type compressors which starts this invention with a drawing is explained. Drawing of longitudinal section and drawing 2 which drawing 1 and drawing 2 show the variable-capacity type compressor 1 equipped with the control valve 100 of this operation form, and show the state where the **** path of this variable-capacity type compressor 1 opened drawing 1 are drawing of longitudinal section showing the state where the **** path closed. The front housing 4 is fixed to an other end side for the rear housing 3 through valve-plate 2a by the end side of the cylinder block 2 of the variable-capacity type compressor 1, respectively. Two or more cylinder bores 6 are arranged every predetermined interval of a hoop direction focusing on a shaft (axis of rotation) 5 by the cylinder block 2. In this cylinder bore 6, a piston 7 is held possible [sliding], respectively.
[0020] A crank case 8 is formed in the front housing 4, and a cam plate 10 is contained in this crank case 8. The shoe 50 supported possible [relative rolling of end section 11a of the shape of a sphere of a connecting rod 11] is held by the retainer 53 at sliding-surface 10a of this cam plate 10. Boss section 10b of a cam plate 10 is equipped with a retainer 53 through radial bearing 55, and relative rotation is possible for it to a cam plate 10. Radial bearing 55 is escaped from, stopped and set to boss section 10b by the stopper 54 fixed with the screw thread 45. Other end 11b of a connecting rod 11 is being fixed to the piston 7.
[0021] The shoe 50 consists of a main part 51 of a shoe supported possible [relative rolling of the apical surface of end section 11a of a connecting rod 11], and a washer 52 supported possible [relative rolling of the back end side of end section 11a of a connecting rod 11]. The regurgitation room 12 and an inhalatorium 13 are formed in the rear housing 3. This inhalatorium 13 is arranged so that the regurgitation room 12 may be surrounded. The inhalation mouth (illustration ellipsis) which leads to the outlet of an evaporator (illustration ellipsis) is prepared in the aforementioned rear housing 3. Drawing 1 shows the state where the regurgitation path 39 opened, and drawing 2 shows the state where this regurgitation path 39 closed. Consisting of

path 39b formed in path 39a by which the spool type valve (regurgitation control valve) 31 is formed in the middle of, and the regurgitation path 39 was formed in the rear housing 3 and valve-plate 2a, this path 39b leads to delivery 1a formed in the cylinder block 2. [the regurgitation path 39 which opens the aforementioned regurgitation room 12 and delivery 1a for free passage]

[0022] The spring (energization member) 32 was held in the cylinder-like-object-with-base-like spool type valve 31, the end of a spring 32 contacted the stopper 56 fixed to the aforementioned rear housing 3 with the cap 59, and the other end of this spring 32 is in contact with the base of a spool type valve 31. The building envelope 33 of this spool type valve 31 is open for free passage to the crank case 8 through a path 34. The energization force of a spring 32 and the pressure of a crank case 8 act on one side (above) of the aforementioned spool type valve 31 in the valve-closing direction (direction where the degree of valve-opening becomes small). On the other hand, since delivery 1a and the regurgitation room 12 are open for free passage through the regurgitation path 39 at the time of valve opening of the aforementioned spool type valve 31 (refer to drawing 1), in another side (below) of the spool type valve 31 at this time, the pressure of delivery 1a and the pressure of the regurgitation room 12 act in the valve-opening direction (direction where the degree of valve-opening becomes large). However, when the pressure differential of a crank case 8 and delivery 1a becomes below a predetermined value, a spool type valve 31 moves in the valve-closing direction, the regurgitation path 39 is intercepted, and only the pressure of the regurgitation room 12 acts on the spool-type-valve 31 bottom in the valve-opening direction. The pressure of delivery 1a stops namely, acting on the spool-type-valve 31 bottom.

[0023] The regurgitation room 12 and a crank case 8 are open for free passage through the second path 57. In the middle of this path 57, the control valve 100 of this operation gestalt which mentions a detail later is formed. When a thermal load is large, the second path 57 is intercepted when a valve element 132 sits down by energization of solenoid 131A of a control valve 100, and when a thermal load is small, and a valve element 132 separates from valve seat 125a by energization halt to solenoid 131A, it is released. The operation of the aforementioned control valve 100 is controlled by the computer (illustration ellipsis).

[0024] The aforementioned inhalatorium 13 and a crank case 8 are open for free passage through the first path 58. the hole formed in orifice (second orifice) 58a by which this path 58 was formed in valve-plate 2a, path 58b formed in the cylinder block 2, and the ring (annular solid) 9 fixed to the shaft 5 -- it consists of 58c The inhalatorium 13 and the crank case 8 are open for free passage through the third path 60. This path 60 consists of path 60a formed in the front housing 4, front side shaft carrier hold space 60b, path 60c formed in the shaft 5, 60d of rear side shaft carrier hold space formed in the cylinder block 2 and path 58b of a cylinder block 2, and orifice 58of valve-plate 2a a. Therefore, orifice 58of path 58b [of the aforementioned cylinder block 2] and aforementioned valve-plate 2a a constitutes a part of third path 60 while constituting a part of first path 58.

[0025] A female screw 61 is formed in the inner skin of the rear side edge section of the aforementioned path 60c, and the screw 62 is thrust into this female screw 61. Orifice (first orifice) 62a is formed in this screw 62, and the path area of this orifice 62a is smaller than the path area of second orifice 58a in valve-plate 2a which constitutes a part of first path 58 of the above on it. therefore, boss section 10b of a cam plate 10 -- the hole of a ring 9 -- only when 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the refrigerant of a crank case 8 is led to an inhalatorium 13 through the third path 60 The inhalation port 15 which makes aforementioned valve-plate 2a open for free passage the regurgitation port 16 which makes compression space 82 and the regurgitation room 12 open for free passage, and compression space 82 and an inhalatorium 13 is established in the hoop direction every predetermined interval, respectively. The regurgitation port 16 is opened and closed by the discharge valve 17, and this discharge valve 17 is fixed to the rear housing side edge side of valve-plate 2a with a bolt 19 and a nut 20 with a valve guard 18. On the other hand, the inhalation port 15 is opened and closed by the suction valve portion 21, and this suction valve portion 21 is arranged between valve-plate 2a and a cylinder block 2.

[0026] The rear side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (rear side shaft carrier) 24 and thrust bearing (rear side shaft carrier) 25 which were contained by 60d of rear side shaft carrier receipt space of a cylinder block 2, and the front side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (front side shaft carrier) 26 held in front side shaft carrier hold space 60b of the front housing 4. The shaft seal 46 other than radial bearing 26 is held in bearing receipt space 60b by the side of a front. Female screw 1b is prepared in the center section of the cylinder block 2, and an adjust nut 83 screws in this female screw 1b. By fastening this adjust nut 83, preloading is given to a shaft 5 through thrust bearing 25. Moreover, a pulley (illustration ellipsis) is fixed to the front side edge section of a shaft 5.

[0027] The thrust flange 40 which transmits rotation of this shaft 5 to a cam plate 10 is fixed to a shaft 5, and this thrust flange 40 is supported by the internal surface of the front housing 4 through thrust bearing 33. The thrust flange 40 and a cam plate 10 are connected through the hinge mechanism 41, and a cam plate 10 can incline to a shaft 5 and a right-angled virtual side. The shaft 5 is equipped with the cam plate 10 possible [sliding and an inclination].

[0028] The hinge mechanism 41 is with 10f of straight-line-like guide slots established in bracket 10e prepared in front side 10c of a cam plate 10, and this bracket 10e, and the rod 43 screwed in cam-plate side side 40a of the thrust flange 40, and is constituted. The longitudinal shaft of 10f of guide slots leans the degree of predetermined angle to front side 10c of a cam plate 10. Spherical section 43a of a rod 43 has fitted into the 10f of the aforementioned guide slots possible [relative sliding].

[0029] Next, the control valve 100 for variable-capacity type compressors of this operation form (henceforth a "control valve") is explained in detail. Drawing of longitudinal section in which drawing of longitudinal section showing the state where drawing 3 included the control valve 100 in the variable-capacity type compressor 1, and drawing 4 show the detail of the control valve of drawing 3 , and drawing 5 are drawings of longitudinal section made to rotate 90 degrees of control valves of drawing 4 . The control valve 100 shown in drawing 3 is formed in the rear housing 3 side of drawing 1 and the variable-capacity type compressor 1 of drawing 2 , and where airtightness is maintained through O rings 121a, 121b, and 131b in the space 84 of this rear housing 3, and 85, it is arranged.

[0030] As shown in drawing 4 , the control valve 100 is formed by the control valve main part 120, the solenoid excitation section 130, and the pressure-sensitive part 145, the aforementioned solenoid excitation section 130 is arranged in the center section, and the aforementioned control valve main part 120 and the aforementioned pressure-sensitive part 145 are arranged at the both sides of this solenoid excitation section 130. The aforementioned solenoid excitation section 130 equips the periphery with the solenoid housing 131, and equips the interior of this solenoid housing 131 with solenoid 131A, the plunger 133 which moves in the vertical direction by excitation of this solenoid 131A, and the suction child 141, and plunger room 130a which has arranged the aforementioned plunger 133 is opening it for free passage with the inhalation refrigerant port 129 with which the aforementioned control valve main part 120 was equipped. The aforementioned pressure-sensitive part 145 is arranged at the solenoid housing 131 bottom, the interior is equipped with pressure-sensitive room 145a, and this pressure-sensitive room 145a is arranging the bellows 146 and the spring 159 which operate the aforementioned plunger 133 through stem 138 grade.

[0031] The aforementioned control valve main part 120 is equipped with the valve chest 123, the valve element 132 which carries out an opening-and-closing operation with the aforementioned plunger 133 is arranged in this valve chest 123, and the refrigerant gas of the high-pressure discharge pressure Pd is led to the valve chest 123 through the path 81 and the **** refrigerant port 126. While the valve port 125 which is open for free passage in the crank case refrigerant port 128 is drilled in the base of the valve chest 123, the space of the upper part of the valve chest 123 is closed by the stopper 124. This stopper 124 counters the core with a valve port 125, the pressure room 151 of the closed-end longitudinal hole of the cross section equal to this valve port 125 is drilled, the pressure room 151 of this closed-end longitudinal hole is formed also as spring receipt room 151a, and the valve-closing spring 127 which energizes a valve

element 132 to the base side of the valve chest 123 is arranged at the bottom.
[0032] The aforementioned valve element 132 is a rod-like structure which consists of up 132a, expansion valve element section 132b, thin diameter section 132c, and 132d of the lower parts. Up 132a and 132d of lower parts are made into the cross section equal to the aforementioned valve port 125. Fitting support is carried out at the stopper 124 with which the aforementioned up 132a has the pressure room 151. The aforementioned expansion valve element section 132b is arranged in the valve chest 123, and it counters with the crank case refrigerant port 128 which the aforementioned thin diameter section 132c opens for free passage in the aforementioned valve port in a crank case (crank case pressure Pc). The 132d of the aforementioned lower parts carries out fitting support at the control valve main part 120, and the edge is inserted in plunger room 130a to which the refrigerant gas of suction pressure Ps is led, and touches the aforementioned plunger 133. The aforementioned valve element 132 moves up and down and expansion valve element section 132b of this valve element 132 adjusts the gap between valve seat 125a of the upper surface of a valve port 125 because this plunger 133 moves up and down.
[0033] As shown in drawing 5 , in the aforementioned stopper 124, the side hole 153 which is open for free passage in the aforementioned pressure room 151 is formed, and this side hole 153 is opening for free passage to it the opening section 139 and the aforementioned pressure room 151 which are formed with a stopper 124 and the control valve main part 120. on the other hand, the cancellation which opens for free passage the aforementioned opening section 139 and plunger room 130a into which the refrigerant gas of suction pressure Ps flows on the control valve main part 120 -- the hole 155 is drilled Therefore, the refrigerant gas of the suction pressure Ps in the aforementioned plunger room 130a It will be led to the aforementioned pressure room 151 through a hole 155. the aforementioned cancellation -- the aforementioned valve element 132 Moreover, the aforementioned suction pressure Ps will be received from lower parts [132a and 132d] both sides. And since 132d is made into vertical section 132a of the aforementioned valve element 132, and the same cross section, the suction pressure Ps received from aforementioned vertical sections [132a and 132d] both sides will balance, and will be offset, and the aforementioned valve element 132 will be substantially influenced of the aforementioned discharge pressure Pd. Moreover, since the crank case refrigerant port 128 neighborhood which is open for free passage to the crank case 8 which has the crank case internal pressure Pc was set to thin diameter section 132c, after valve element section 132b of the aforementioned valve element 132 has sat down to valve seat 125a, even if the aforementioned valve element 132 receives the pressure Pc in a crank case, the force of the vertical direction balances and the unnecessary force does not act on a valve element 132.
[0034] And the suction pressure Ps of the low temperature led to plunger room 130a is led also to the suction pressure introduction space 85 between the aforementioned rear housing 3 and the solenoid housing 131 while it is drawn in the pressure-sensitive part 145 mentioned later (drawing 3). This suction pressure introduction space 85 is sealed through O ring 131b of projected part 131a prepared in the flank of the solenoid housing 131, and is aiming at cooling of the whole side of the solenoid housing 131 by the refrigerant gas of the low temperature from the aforementioned inhalatorium 13 side.
[0035] The plunger 133 which carries out connection fixation of the aforementioned valve element 132 as shown in drawing 4 is arranged in the solenoid housing 131 interior, and this plunger 133 is supported free [sliding] by the pipe 136 which touches a close state through O ring 134a at the edge of the aforementioned control valve main part 120. the hold formed in the back end section of a plunger 133 -- while insertion fixation of the upper-limit section 138a of a stem 138 is carried out at a hole 137 -- soffit section 138b of the aforementioned stem 138 -- front end section hold of the suction child 141 -- the back end section hold from a hole 142 side -- it is in the state projected to a hole 143 side, and is supported free [sliding] to the suction child 141 front end section hold of the aforementioned plunger 133 and the aforementioned suction child 141 -- between holes 142, the valve-opening spring 144 energized in the direction which separates a plunger 133 from the suction child 141 side is formed
[0036] moreover, a stopper 147 side equips soffit section 138b of a stem 138 free [attachment

and detachment] among the stoppers 147,148 of the couple of the bellows 146 interior arranged in pressure-sensitive room 145a — having — the back end section hold by the side of the flange 149 of this stopper 147, and the aforementioned suction child 141 — between holes 143, the spring 150 energized in the direction which separates a stopper 147 from the suction child 141 side is formed the suction pressure Ps in pressure-sensitive room 145a becomes high, and stopper 147,148 comrades of a couple contact by contraction of bellows 146 — the variation rate of bellows 146 — a position regulates — having — this maximum — a variation rate — an amount is set up so that it may become smaller than the amount of the maximum fitting of soffit section 138b of the aforementioned stem 138, and the stopper 147 of bellows 146 In addition, the code 158 which can supply the exciting current controlled by the control computer (illustration abbreviation) is connected to aforementioned solenoid 131A (drawing 3).

[0037] Next, an operation with the variable-capacity type compressor 1 of this operation form and a control valve 100 is explained. The rotational-motion force of a mounted engine is always transmitted to the aforementioned shaft 5 from a pulley (illustration abbreviation) through a belt (illustration abbreviation), and the turning effort of a shaft 5 is transmitted to a cam plate 10 through the thrust flange 40 and the hinge mechanism 41, and rotates this cam plate 10.

[0038] A shoe 50 carries out relative rotation of the sliding-surface 10a top of a cam plate 10 by rotation of a cam plate 10, it is changed into straight-line reciprocating movement of a piston 7, as a result, the capacity of the compression space 82 in a cylinder bore 6 changes, inhalation of a refrigerant gas, compression, and **** are performed one by one by this capacity change, and the refrigerant gas of capacity according to the degree of tilt angle of a cam plate 10 is breathed out. First, when a thermal load becomes large, the inflow of a refrigerant gas is prevented from the **** room 12 by the crank case 8, the pressure of a crank case 8 is low, and the force produced in the rear side of the piston 7 in a compression stroke becomes small, and when total of the force produced in the rear side of a piston 7 is less than total of the force produced in the front side (top side) of a piston 7, the degree of tilt angle of a cam plate 10 becomes large.

[0039] The pressure of the **** room 12 becomes high and the pressure differential of the **** room 12 and a crank case 8 becomes here beyond a predetermined value. When the pressure of the refrigerant gas of the **** room 12 which acts on the spool-type-valve 31 bottom overcomes the pressure of the refrigerant gas of a crank case 8 which acts on the spool-type-valve 31 bottom, and resultant force of the energization force of a spring 32 A spool type valve 31 moves in the valve-opening direction, the **** path 39 opens (drawing 1), and the refrigerant gas of the **** room 12 flows out of delivery 1a into a capacitor 88. In addition, since boss section 10b of a cam plate 10 separates from hole 58c of a ring 9, the first path 58 is opened fully and the refrigerant gas of a crank case 8 flows to an inhalatorium through the first path 58 when the degree of tilt angle of a cam plate 10 becomes the maximum from the minimum, the failure of pressure of a crank case 8 happens. Moreover, if the path area of the first path 58 becomes the maximum, in an inhalatorium 13, a refrigerant gas will hardly flow from the third path 60.

[0040] Thus, when a thermal load becomes large and solenoid 131A of a control valve 100 is excited, a plunger 133 is drawn in the suction child 141 side, it moves in the direction in which the valve element 132 connected with the plunger 133 closes a valve port 125, and the inflow of a crank case 8 is prevented. On the other hand, a low-temperature refrigerant gas is led to a pressure-sensitive part 145 through the inhalation refrigerant port 129 of the control valve main part 120, and plunger room 130a from the path 80 side which is open for free passage to an inhalatorium 13, the bellows 146 of a pressure-sensitive part 145 is displaced based on the pressure of the aforementioned refrigerant gas which is the suction pressure Ps of an inhalatorium 13, and this displacement is transmitted to the aforementioned valve element 132 through the aforementioned stem 138 and the aforementioned plunger 133. That is, the opening position to the aforementioned valve port 125 of the aforementioned valve element 132 is determined by the suction force by the aforementioned solenoid 131A, the energization force of the aforementioned bellows 146, and the energization force of the aforementioned valve-closing spring 127 and the valve-opening spring 144.

[0041] And if the pressure in the aforementioned pressure-sensitive room 145a (suction

pressure Ps) becomes high, since the aforementioned bellows 146 contracts and this is in agreement with the suction direction of the aforementioned plunger 133 by the aforementioned solenoid 131A, movement of the aforementioned valve element 132 follows the variation rate of bellows 146, and the opening of the aforementioned valve port 125 decreases. Thereby, the amount of the high-pressure refrigerant gas drawn in the valve chest 123 from the **** room 12 decreases (the crank case pressure Pc declines), and the degree of tilt angle of a cam plate 10 increases it (drawing 1). Moreover, if the pressure in the aforementioned pressure-sensitive room 145a becomes low, it will elongate according to the stability of spring 159 and bellows 146 self, the aforementioned bellows 146 will move in the direction in which a valve element 132 increases the opening of a valve port 125, the amount of the high-pressure refrigerant gas drawn in the valve chest 123 will increase (the crank case pressure Pc increases), and the degree of tilt angle of the cam plate 10 in the state of drawing 1 will decrease.

[0042] On the other hand, when a thermal load becomes small, a high-pressure refrigerant gas flows out of the **** room 12 into a crank case 8, and the pressure of this crank case 8 becomes high. And the force produced in the rear side of the piston 7 in a compression stroke becomes large, and when total of the force produced in the rear side of a piston 7 exceeds total of the force produced in the front side of a piston 7, the degree of tilt angle of a cam plate 10 becomes small.

[0043] Here, the pressure differential of the aforementioned **** room 12 and a crank case 8 becomes below a predetermined value, when resultant force with the pressure of a crank case 8 and the energization force of a spring 32 of acting on the spool-type-valve 31 bottom overcomes the pressure of the refrigerant gas of the **** room 12 which acts on the spool-type-valve 31 bottom, a spool type valve 31 moves in the valve-closing direction, the **** path 39 is intercepted (drawing 2), and the outflow of the refrigerant gas to a capacitor 88 is prevented from delivery 1a. in addition -- the time of the degree of tilt angle of a cam plate 10 serving as the minimum from the maximum -- boss section 10b of a cam plate 10 -- the hole of a ring 9 -- although 58c is closed mostly and the path cross section of the first path 58 is decreased sharply, since the refrigerant gas in a crank case 8 flows to an inhalatorium 13 through the third path 60, the overpressure rise in a crank case 8 is suppressed, and circulation of the refrigerant gas in a compressor 1 is attained That is, a refrigerant gas returns to an inhalatorium 13 again through an inhalatorium 13, compression space 82, the **** room 12, the second path 57, a crank case 8, and the third path 60 in this case. The pressure of a crank case 8 is made to act on one side of the spool type valve 31 as a **** control valve with this operation form. The structure of making the pressure of the **** room 12 acting is adopted as another side of a spool type valve 31. The spring 32 which has the comparatively small spring force energized in the valve-closing direction as a spool type valve 31 is used. A spool type valve 31 is maintained at the state where it opened until it becomes the minimum piston stroke (super-low load) and a cam plate 10 decreases the path area of the first path 58, when a thermal load becomes small and the pressure of the **** room 12 declines gradually.

[0044] Thus, when a thermal load becomes small and the aforementioned solenoid 131A is demagnetized, suction to a plunger 133 disappears, it moves in the direction in which the aforementioned plunger 133 separates from the aforementioned suction child 141 side according to the energization force of the aforementioned valve-opening spring 144, a valve element 132 moves in the direction which opens the valve port 125 of the control valve main part 120, and the inflow to a crank case 8 is promoted. Here, if the pressure in the aforementioned pressure-sensitive part 145 rises, although the aforementioned bellows 146 will contract and the opening of a valve element 132 will decrease, since it is equipped with soffit section 138b of the aforementioned stem 138 free [attachment and detachment] to the stopper 147 of the aforementioned bellows 146, the variation rate of the aforementioned bellows 146 does not affect it to a valve element 132.

[0045] The solenoid excitation section 130 to which the control valve 100 of this operation gestalt equipped the center section with the plunger 133 which moves in the vertical direction by excitation of solenoid 131A as mentioned above, The pressure-sensitive part 145 which arranged the bellows 146 interlocked with a plunger 133 through stem 138 grade at this solenoid

excitation section 130 bottom, Since it is formed with the control valve main part 120 which has the valve chest 123 which arranged in the aforementioned solenoid housing 131 bottom the valve element 132 grade interlocked with a plunger 133, Approach arrangement of pressure-sensitive room 145a and the solenoid 131A can be carried out, the point of application by suction of solenoid 131A and the point of application by bellows 146 can approach, and it can hold down with [at the time of movement in the valve-closing direction of the valve element 132 and stem 138 which constitute an operation lever] backlash to necessary minimum.

[0046] While it has the pressure room 151 of the closed-end longitudinal hole of the same cross section as a valve port 125 and this pressure room 151 and the opening section 139 are open for free passage with a side hole 153, a stopper 124 the aforementioned opening section 139 and plunger room 130a — cancellation — since it is open for free passage with the hole 155, the pressure of plunger room 130a of the control valve main part 120 and the pressure of the pressure room 151 turn into both the suction pressure Ps, and the pressure in the vertical edge of the movable direction of a valve element 132 always becomes equal Therefore, with this operation gestalt, balance can always be maintained in the valve element 132 upper and lower sides by the change in the crank case pressure Pc to the force of acting on a valve element changing and the balance of the valve element upper and lower sides changing like [in the case of making the valve element upper and lower sides of the aforementioned conventional example into the crank case pressure Pc]. Moreover, when the maximum discharging volume operation of a compressor 1 is performed, a valve element 132 is strongly forced to valve seat 125a by the discharge pressure Pd, and supply of a refrigerant gas to the second path 57 of a compressor 1 can prevent a bird clapper difficult by it. For this reason, similarly the opening of a valve port 125 is controllable to the same current value.

[0047]

[Effect of the Invention] Since the control valve for variable-capacity type compressors concerning this invention was considered as the composition which the suction pressure of a refrigerant gas was made to act on the vertical ends of the valve element of a rod-like structure, and balanced, it can lose the bad influence of the operation of a valve element based on the pressure variation of a refrigerant gas, and can raise the opening-and-closing precision of a valve element, so that I may be understood from the above explanation.

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the control valve for variable-capacity type compressors used for air conditioners, such as vehicles, and relates to the control valve for variable-capacity type compressors which accepts the need and controls supply of the refrigerant gas in a crank case from a discharge-pressure field especially.

[Translation done.]

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PRIOR ART

[Description of the Prior Art] It is used in order that the variable-capacity type compressor equipped with the cylinder, the piston, the cam plate, etc. may compress and carry out the regurgitation of the refrigerant gas of the conditioner for automobiles from the former, and what was constituted so that the degree of tilt angle of a cam plate might be changed and discharging volume might be changed is known by equipping this variable-capacity type compressor with the refrigerant gas passageway which opens a discharge-pressure field and a crank case for free passage, and adjusting the pressure in the aforementioned crank case. Pressure regulation in a crank case is performed by opening adjustment of the control valve prepared in the middle of the refrigerant gas passageway by supplying a high-pressure compression refrigerant gas to the aforementioned crank case from the aforementioned discharge-pressure field.
[0003] As such a control valve, there is control valve 100' for variable-capacity type compressors (henceforth a "control valve") as shown in drawing 6 and drawing 7 , for example (refer to JP,9-268973,A). This control valve 100' is prepared in the rear housing 210 side of the variable-capacity type compressor 200, and performs pressure regulation of the crank case 231 in the front housing 230 it is connected [front / cylinder block / of the variable-capacity type compressor 200 / 220].
[0004] The cam plate slack cam plate 240 is supported possible [a slide and ****] in the direction of an axis of the drive shaft 250, and the guide pin 241 of a cam plate 240 is supported free [a slide on the support arm 252 of the rotation base material 251] by the crank case 231 interior. Moreover, the cam plate 240 is connected with the piston 260 arranged free [sliding] in a cylinder bore 221 through the shoe 242 of the couple of this cam plate 240.
[0005] According to the difference of the suction pressure Ps in a cylinder bore 221, and the crank case pressure Pc in a crank case 231, the aforementioned cam plate 240 rotates in the direction of an arrow, and changes the degree of tilt angle. It is based on this degree of tilt angle, and the stroke width of the longitudinal slide movement in the cylinder bore 221 of a piston 260 is determined. and the interception object 270 which contacts the mountain side section of a cam plate 240 with rotation of the direction of an arrow of a cam plate 240 -- hold -- longitudinal slide movement of the inside of a hole 222 is carried out
[0006] When partition formation of the regurgitation rooms 212a and 212b which constitute Inhalatoriums 211a and 211b and the discharge-pressure field which constitute an inlet-pressure field is carried out and a piston 260 carries out longitudinal slide movement to the rear housing 210 based on rotation of the aforementioned cam plate 240, after the refrigerant gas in inhalatorium 211a is inhaled in a cylinder bore 221 from the inhalation port 213 and is compressed into a predetermined pressure, it is breathed out by regurgitation room 212a from the regurgitation port 214.
[0007] furthermore, the inhalation path 215 formed in a part for the core of the rear housing 210 -- the aforementioned hold -- whil it is open for free passage to a hole 222, it is open for free passage to the aforementioned inhalatorium 211b through a through-hole 216 Here, if a cam plate 240 moves to the interception object 270 side, this interception object 270 will move to the aforementioned inhalation path 215 side, and will close a through-hole 216. The upper part sid of the inhalation path 215 and control valve 100' is opened for free passage by the pressure-

taking path 217 which draws suction pressure Ps in control valve 100', and regurgitation room 212b and a crank case 231 are opened for free passage through the air-supply path 218,219 of control valve 100', and this air-supply path 218,219 is opened and closed by valve element 106of control valve 100' '.

[0008] Through the air-supply path 218, the crank case internal pressure Pc is led to the air-supply path 219 through valve port port 114', and suction pressure Ps is led to valve chest port 113' for the discharge pressure Pd of regurgitation room 212b through the pressure-taking path 217 at inlet-pressure introduction port 115'. When the detection temperature of the indoor sensor 281 is more than the setting temperature of the room temperature setter 282 when the operation switch 280 of an air conditioner is ON for example, it is ordered excitation of solenoid 101' of control valve 100', predetermined current is supplied to solenoid 101' through the drive circuit 284, and movable iron core 102' can draw a control computer 283 near to a fixed iron core 104' side according to the suction force of this solenoid 101', and the energization force of spring 103'.

[0009] Valve element 106' attached in solenoid rod 105' moves the opening of valve port 108' to the side which decreases with movement of movable iron core 102', resisting the energization force of compulsive opening spring 107'. With this movement, valve element 106' and pressure-sensitive rod 109' of one also go up, and bellows 111' connected free [attachment and detachment] is forced through pressure-sensitive rod receptacle section 110'.

[0010] This bellows 111' is displaced according to change of the suction pressure Ps introduced in pressure-sensitive part 112' through the pressure-taking path 217, and gives a load to aforementioned pressure-sensitive rod 109'. That is, control valve 100' determines the degree of valve-opening of valve port 108' by valve element 106' by balance with the suction force by aforementioned solenoid 101', the energization force of aforementioned bellows 111', the energization force of aforementioned forcible opening spring 107', etc.

[0011] When large (a cooling load is large) as mentioned above, the difference of the detection temperature of the indoor sensor 281 and the setting temperature of the room temperature setter 282 is attracted by the increase in current value, movable iron core 102' is attracted by fixed iron core 104', the increase of the force which decreases the opening of valve port 108' of valve element 106', and control valve 100' operate so that the low suction pressure Ps may be held more, and opening and closing of aforementioned valve element 106' are performed by this pressure.

[0012] If the degree of valve-opening becomes small, since the refrigerant capacity which flows from regurgitation room 212b to a crank case 231 through the air-supply path 218,219 will decrease and the gas of a crank case 231 will flow into Inhalatoriums 211a and 211b simultaneously, the crank case internal pressure Pc becomes low. And when a cooling load is large, the suction pressure Ps in the aforementioned cylinder bore 221 is high, and produces a difference in this suction pressure Ps and the aforementioned crank case internal pressure Pc, the degree of tilt angle of the aforementioned cam plate 240 is large, by the bird clapper, the aforementioned interception object 270 separates from the aforementioned inhalation path 215 side, and a path 216 is opened.

[0013] furthermore, when the heat-exchange capacity of the condenser in a refrigerating cycle falls remarkably and the maximum discharging volume operation of a compressor is performed, such as at for example, the time of traffic congestion of midsummer etc., aforementioned control valve 100' While a discharge pressure Pd becomes very high, the crank case internal pressure Pc serves as a value near suction pressure Ps. In order that valve element 106' may be strongly forced to a valve seat by the pressure differential of these discharge pressures Pd and the crank case internal pressure Pc and opening of an air-supply path may prevent a bird clapper etc. difficult by it, The vertical edge of valve element 106' is equipped with solenoid rod 105' and pressure-sensitive rod 109'. When the path of solenoid rod 105' is mad equal to the path of valve port 108' and valv element 106' closes valve port 108', it is made for the pressure-receiving area of the movable direction both sides of valve element 106' to become almost equal. The crank case internal pressure Pc is introduced into valve port 108' through the air-supply path 219 and port 114'. And while this pressure Pc is drawn in solenoid room 117' through areole

118', run through-hole 119', free passage slot 120', etc. and making it the pressure of this solenoid room 117' and the pressure of aforementioned valve port 108' become the same By lessening influence of pressure-sensitive rod narrow diameter portion 110' as much as possible, and making the cross section of pressure-sensitive rod 109' smaller than the effective-area product of valve port 108' by making small the cross section of pressure-sensitive rod 109' itself Reduction of the influence of a pressure which acts on solenoid rod 105', valve element 106', and pressure-sensitive rod 109' is aimed at, and it is made for the pressure produced on movable direction both sides of valve element 106' to become equal. Moreover, aforementioned solenoid rod 105', valve element 106', and pressure-sensitive rod 109' are formed in one, and the above-mentioned cancellation mechanism is constituted.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since the control valve for variable-capacity type compressors concerning this invention was considered as the composition which the suction pressure of a refrigerant gas was made to act on the vertical ends of the valve element of a rod-like structure, and balanced, it can lose the bad influence of the operation of a valve element based on the pressure variation of a refrigerant gas, and can raise the opening-and-closing precision of a valve element, so that I may be understood from the above explanation.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] by the way, in conventional control valve 100' mentioned above As shown in drawing 6 and drawing 7 , valve chest 116' was prepared in the center of a control valve main part, the pressure-sensitive part is prepared in the bottom, and solenoid room 117' is prepared in the valve chest bottom. as a cancellation mechanism While the crank case internal pressure Pc of a medium voltage is led to valve port 108' and solenoid room 117' which were prepared in the vertical edge of valve chest 116', the high-pressure discharge pressure Pd is led to valve chest port 113' through the air-supply path 218. Although it is adjusting about the pressure-receiving area which is the movable direction bottom of valve element 106', and receives the crank case internal pressure Pc so that each pressure-receiving area of valve port 108' and solenoid rod 105' may not be pressure influenced, since suction pressure Ps and the crank case internal pressure Pc are not in the always same pressure state, the cancellation rate will not be fixed and cannot say that it is canceled completely.
[0015] Moreover, since the pressure fluctuation difference by operation of a compressor is large, if this pressure fluctuation arises, the force of acting on valve element 106' will also be changed, and a problem that it has a bad influence on the opening-and-closing precision of valve element 106' produces the pressure in a crank case. It is offering the control valve for variable-capacity type compressors which this invention's is made in view of such a trouble, and the place made into the purpose loses the bad influence by the refrigerant gas pressure which acts on the valve element of a control valve, and raises valve-opening close precision.

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MEANS

[Means for Solving the Problem] The control valve for variable-capacity type compressors concerning this invention that the aforementioned purpose should be attained In the control valve for variable-capacity type compressors equipped with the solenoid excitation section arranged in the center section, the control valve main part arranged to the unilateral of this solenoid excitation section, and the pressure-sensitive part arranged to the side else The valve element of the rod-like structure which the aforementioned control valve main part is arranged in the valve chest which has a valve port on a base, and this valve chest, and carries out an opening-and-closing operation with the plunger of the aforementioned solenoid excitation section, While having the pressure room arranged above the aforementioned valve chest, opening the plunger room and the aforementioned pressure room of the aforementioned solenoid excitation section for free passage and the aforementioned valve element's inserting the up edge in the aforementioned pressure room, it is characterized by inserting a lower edge in a plunger room.
[0017] Moreover, the aforementioned control valve main part is characterized by having the regurgitation refrigerant port which is open for free passage to the aforementioned valve chest, the crank case refrigerant port which is open for free passage to the aforementioned valve port, and the inhalation refrigerant port which is open for free passage in the aforementioned plunger room. Furthermore, the aforementioned pressure room forms in the stopper arranged in the upper part of the aforementioned valve chest, and the aforementioned valve element is the rod-like structure which consists of the upper part, the expansion valve element section, a thin diameter section, and the lower part, and the aforementioned expansion valve element section arranges in the aforementioned valve chest, the aforementioned thin diameter section arranges in the aforementioned valve port, fitting support carries out to the aforementioned stopper in the aforementioned upper part, and it is carrying out having carried out fitting support to the aforementioned control valve main part in the aforementioned lower part as the feature.
[0018] the cancellation which it was characterized by the upper part, the lower part, and the aforementioned valve port of the aforementioned valve element making the cross section equal, and the valve-closing spring which energizes the aforementioned valve element to the aforementioned valve chest side has been arranged in the aforementioned pressure interior of a room, and drilled the aforementioned pressure room and the aforementioned plunger room in the aforementioned control valve main part further again -- it is characterized by to be open for free passage through a hole The control valve for variable-capacity type compressors concerning this invention constituted like the above the refrigerant gas of the suction pressure Ps of the plunger interior of a room -- cancellation -- a valve element, since it is led to a pressure room through a hole Moreover, the aforementioned suction pressure Ps will be received from lower both sides. Since the vertical section of the aforementioned valve element is made into the same cross section, it becomes impossible to influence the aforementioned valve element of the aforementioned discharge pressure Pd, it can always maintain balance in the valve element upper and lower sides, and the opening-and-closing precision of a valve can be raised. moreover, the cancellation mechanism of the control valve concerning this invention -- a stopper, the opening section, and cancellation -- since it consists of a hole etc. and is arranged in the control valve

main part, as compared with the former, composition becomes easy, and curtailment of part mark and reduction of a manufacturing cost can be aimed at

[0019]

[Embodiments of the Invention] Hereafter, 1 operation gestalt of the control valve for variable-capacity type compressors which starts this invention with a drawing is explained. Drawing of longitudinal section and drawing 2 which drawing 1 and drawing 2 show the variable-capacity type compressor 1 equipped with the control valve 100 of this operation gestalt, and show the state where the regurgitation path of this variable-capacity type compressor 1 opened drawing 1 are drawing of longitudinal section showing the state where the regurgitation path closed. The front housing 4 is fixed to an other end side for the rear housing 3 through valve-plate 2a by the end side of the cylinder block 2 of the variable-capacity type compressor 1, respectively. Two or more cylinder bores 6 are arranged every predetermined interval of a hoop direction focusing on a shaft (axis of rotation) 5 by the cylinder block 2. In this cylinder bore 6, a piston 7 is held possible [sliding], respectively.

[0020] A crank case 8 is formed in the front housing 4, and a cam plate 10 is contained in this crank case 8. The shoe 50 supported possible [relative rolling of end section 11a of the shape of a sphere of a connecting rod 11] is held by the retainer 53 at sliding-surface 10a of this cam plate 10. Boss section 10b of a cam plate 10 is equipped with a retainer 53 through radial bearing 55, and relative rotation is possible for it to a cam plate 10. Radial bearing 55 is escaped from, stopped and set to boss section 10b by the stopper 54 fixed with the screw thread 45. Other end 11b of a connecting rod 11 is being fixed to the piston 7.

[0021] The shoe 50 consists of a main part 51 of a shoe supported possible [relative rolling of the apical surface of end section 11a of a connecting rod 11], and a washer 52 supported possible [relative rolling of the back end side of end section 11a of a connecting rod 11]. The regurgitation room 12 and an inhalatorium 13 are formed in the rear housing 3. This inhalatorium 13 is arranged so that the regurgitation room 12 may be surrounded. The inhalation mouth (illustration ellipsis) which leads to the outlet of an evaporator (illustration ellipsis) is prepared in the aforementioned rear housing 3. Drawing 1 shows the state where the regurgitation path 39 opened, and drawing 2 shows the state where this regurgitation path 39 closed. Consisting of path 39b formed in path 39a by which the spool type valve (regurgitation control valve) 31 is formed in the middle of, and the regurgitation path 39 was formed in the rear housing 3 and valve-plate 2a, this path 39b leads to delivery 1a formed in the cylinder block 2. [the regurgitation path 39 which opens the aforementioned regurgitation room 12 and delivery 1a for free passage]

[0022] The spring (energization member) 32 was held in the cylinder-like-object-with-base-like spool type valve 31, the end of a spring 32 contacted the stopper 56 fixed to the aforementioned rear housing 3 with the cap 59, and the other end of this spring 32 is in contact with the base of a spool type valve 31. The building envelope 33 of this spool type valve 31 is open for free passage to the crank case 8 through a path 34. The energization force of a spring 32 and the pressure of a crank case 8 act on one side (above) of the aforementioned spool type valve 31 in the valve-closing direction (direction where the degree of valve-opening becomes small). On the other hand, since delivery 1a and the regurgitation room 12 are open for free passage through the regurgitation path 39 at the time of valve opening of the aforementioned spool type valve 31 (refer to drawing 1), in another side (below) of the spool type valve 31 at this time, the pressure of delivery 1a and the pressure of the regurgitation room 12 act in the valve-opening direction (direction where the degree of valve-opening becomes large). However, when the pressure differential of a crank case 8 and delivery 1a becomes below a predetermined value, a spool type valve 31 moves in the valve-closing direction, the regurgitation path 39 is intercepted, and only the pressure of the regurgitation room 12 acts on the spool-type-valve 31 bottom in the valve-opening direction. The pressure of delivery 1a stops namely, acting on the spool-type-valve 31 bottom.

[0023] The regurgitation room 12 and a crank case 8 are open for free passage through the second path 57. In the middle of this path 57, the control valve 100 of this operation gestalt which mentions a detail later is formed. When a thermal load is large, the second path 57 is

intercepted when a valve element 132 sits down by energization of solenoid 131A of a control valve 100, and when a thermal load is small, and a valve element 132 separates from valve seat 125a by energization halt to solenoid 131A, it is released. The operation of the aforementioned control valve 100 is controlled by the computer (illustration ellipsis).
[0024] The aforementioned inhalatorium 13 and a crank case 8 are open for free passage through the first path 58. the hole formed in orifice (second orifice) 58a by which this path 58 was formed in valve-plate 2a, path 58b formed in the cylinder block 2, and the ring (annular solid) 9 fixed to the shaft 5 -- it consists of 58c The inhalatorium 13 and the crank case 8 are open for free passage through the third path 60. This path 60 consists of path 60a formed in the front housing 4, front side shaft carrier hold space 60b, path 60c formed in the shaft 5, 60d of rear side shaft carrier hold space formed in the cylinder block 2 and path 58b of a cylinder block 2, and orifice 58of valve-plate 2a a. Therefore, orifice 58of path 58b [of the aforementioned cylinder block 2] and aforementioned valve-plate 2a a constitutes a part of third path 60 while constituting a part of first path 58.
[0025] A female screw 61 is formed in the inner skin of the rear side edge section of the aforementioned path 60c, and the screw 62 is thrust into this female screw 61. Orifice (first orifice) 62a is formed in this screw 62, and the path area of this orifice 62a is smaller than the path area of second orifice 58a in valve-plate 2a which constitutes a part of first path 58 of the above on it. therefore, boss section 10b of a cam plate 10 -- the hole of a ring 9 -- only when 58c is closed mostly and the path cross section of the first path 58 decreases sharply, the refrigerant of a crank case 8 is led to an inhalatorium 13 through the third path 60 The inhalation port 15 which makes aforementioned valve-plate 2a open for free passage the regurgitation port 16 which makes compression space 82 and the regurgitation room 12 open for free passage, and compression space 82 and an inhalatorium 13 is established in the hoop direction every predetermined interval, respectively. The regurgitation port 16 is opened and closed by the discharge valve 17, and this discharge valve 17 is fixed to the rear housing side edge side of valve-plate 2a with a bolt 19 and a nut 20 with a valve guard 18. On the other hand, the inhalation port 15 is opened and closed by the suction valve portion 21, and this suction valve portion 21 is arranged between valve-plate 2a and a cylinder block 2.
[0026] The rear side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (rear side shaft carrier) 24 and thrust bearing (rear side shaft carrier) 25 which were contained by 60d of rear side shaft carrier receipt space of a cylinder block 2, and the front side edge section of a shaft 5 is supported possible [rotation] by the radial bearing (front side shaft carrier) 26 held in front side shaft carrier hold space 60b of the front housing 4. The shaft seal 46 other than radial bearing 26 is held in bearing receipt space 60b by the side of a front. Female screw 1b is prepared in the center section of the cylinder block 2, and an adjust nut 83 screws in this female screw 1b. By fastening this adjust nut 83, preloading is given to a shaft 5 through thrust bearing 25. Moreover, a pulley (illustration ellipsis) is fixed to the front side edge section of a shaft 5.
[0027] The thrust flange 40 which transmits rotation of this shaft 5 to a cam plate 10 is fixed to a shaft 5, and this thrust flange 40 is supported by the internal surface of the front housing 4 through thrust bearing 33. The thrust flange 40 and a cam plate 10 are connected through the hinge mechanism 41, and a cam plate 10 can incline to a shaft 5 and a right-angled virtual side. The shaft 5 is equipped with the cam plate 10 possible [sliding and an inclination].
[0028] The hinge mechanism 41 is with 10f of straight-line-like guide slots established in bracket 10e prepared in front side 10c of a cam plate 10, and this bracket 10e, and the rod 43 screwed in cam-plate side side 40a of the thrust flange 40, and is constituted. The longitudinal shaft of 10f of guide slots leans the degree of predetermined angle to front side 10c of a cam plate 10. Spherical section 43a of a rod 43 has fitted into the 10f of the aforementioned guide slots possible [relative sliding].
[0029] Next, the control valve 100 for variable-capacity type compressors of this operation gestalt (henceforth a "control valve") is explained in detail. Drawing of longitudinal section in which drawing of longitudinal section showing the state where drawing 3 included the control valve 100 in the variable-capacity type compressor 1, and drawing 4 show the detail of the

control valve of drawing 3 , and drawing 5 are drawings of longitudinal section made to rotate 90 degrees of control valves of drawing 4 . The control valve 100 shown in drawing 3 is formed in the rear housing 3 side of drawing 1 and the variable-capacity type compressor 1 of drawing 2 , and where airtightness is maintained through O rings 121a, 121b, and 131b in the space 84 of this rear housing 3, and 85, it is arranged.

[0030] As shown in drawing 4 , the control valve 100 is formed by the control valve main part 120, the solenoid excitation section 130, and the pressure-sensitive part 145, the aforementioned solenoid excitation section 130 is arranged in the center section, and the aforementioned control valve main part 120 and the aforementioned pressure-sensitive part 145 are arranged at the both sides of this solenoid excitation section 130. The aforementioned solenoid excitation section 130 equips the periphery with the solenoid housing 131, and equips the interior of this solenoid housing 131 with solenoid 131A, the plunger 133 which moves in the vertical direction by excitation of this solenoid 131A, and the suction child 141, and plunger room 130a which has arranged the aforementioned plunger 133 is opening it for free passage with the inhalation refrigerant port 129 with which the aforementioned control valve main part 120 was equipped. The aforementioned pressure-sensitive part 145 is arranged at the solenoid housing 131 bottom, the interior is equipped with pressure-sensitive room 145a, and this pressure-sensitive room 145a is arranging the bellows 146 and the spring 159 which operate the aforementioned plunger 133 through stem 138 grade.

[0031] The aforementioned control valve main part 120 is equipped with the valve chest 123, the valve element 132 which carries out an opening-and-closing operation with the aforementioned plunger 133 is arranged in this valve chest 123, and the refrigerant gas of the high-pressure discharge pressure Pd is led to the valve chest 123 through the path 81 and the regurgitation refrigerant port 126. While the valve port 125 which is open for free passage in the crank case refrigerant port 128 is drilled in the base of the valve chest 123, the space of the upper part of the valve chest 123 is closed by the stopper 124. This stopper 124 counters the core with a valve port 125, the pressure room 151 of the closed-end longitudinal hole of the cross section equal to this valve port 125 is drilled, the pressure room 151 of this closed-end longitudinal hole is formed also as spring receipt room 151a, and the valve-closing spring 127 which energizes a valve element 132 to the base side of the valve chest 123 is arranged at the pars basilaris ossis occipitalis.

[0032] The aforementioned valve element 132 is a rod-like structure which consists of up 132a, expansion valve element section 132b, thin diameter section 132c, and 132d of the lower parts. Up 132a and 132d of lower parts are made into the cross section equal to the aforementioned valve port 125. Fitting support is carried out at the stopper 124 with which the aforementioned up 132a has the pressure room 151. The aforementioned expansion valve element section 132b is arranged in the valve chest 123, and it counters with the crank case refrigerant port 128 which the aforementioned thin diameter section 132c opens for free passage in the aforementioned valve port in a crank case (crank case pressure Pc). The 132d of the aforementioned lower parts carries out fitting support at the control valve main part 120, and the edge is inserted in plunger room 130a to which the refrigerant gas of suction pressure Ps is led, and touches the aforementioned plunger 133. The aforementioned valve element 132 moves up and down and expansion valve element section 132b of this valve element 132 adjusts the gap between valve seat 125a of the upper surface of a valve port 125 because this plunger 133 moves up and down.

[0033] As shown in drawing 5 , in the aforementioned stopper 124, the side hole 153 which is open for free passage in the aforementioned pressure room 151 is formed, and this side hole 153 is opening for free passage to it the opening section 139 and the aforementioned pressure room 151 which are formed with a stopper 124 and the control valve main part 120. on the other hand, the cancellation which opens for free passage the aforementioned opening section 139 and plunger room 130a into which the refrigerant gas of suction pressure Ps flows on the control valve main part 120 — th hole 155 is drilled Therefore, the refrigerant gas of the suction pressure Ps in the aforementioned plunger room 130a It will be led to the aforementioned pressure room 151 through a hole 155. the aforementioned cancellation — the aforementioned

valve element 132 Moreover, the aforementioned suction pressure Ps will be received from lower parts [132a and 132d] both sides. And since 132d is made into vertical section 132a of the aforementioned valve element 132, and the same cross section, the suction pressure Ps received from aforementioned vertical sections [132a and 132d] both sides will balance, and will be offset, and the aforementioned valve element 132 will be substantially influenced of the aforementioned discharge pressure Pd. Moreover, since the crank case refrigerant port 128 neighborhood which is open for free passage to the crank case 8 which has the crank case internal pressure Pc was set to thin diameter section 132c, after valve element section 132b of the aforementioned valve element 132 has sat down to valve seat 125a, even if the aforementioned valve element 132 receives the pressure Pc in a crank case, the force of the vertical direction balances and the unnecessary force does not act on a valve element 132.
[0034] And the suction pressure Ps of the low temperature led to plunger room 130a is led also to the suction pressure introduction space 85 between the aforementioned rear housing 3 and the solenoid housing 131 while it is drawn in the pressure-sensitive part 145 mentioned later (drawing 3). This suction pressure introduction space 85 is sealed through O ring 131b of projected part 131a prepared in the flank of the solenoid housing 131, and is aiming at cooling of the whole side of the solenoid housing 131 by the refrigerant gas of the low temperature from the aforementioned inhalatorium 13 side.
[0035] The plunger 133 which carries out connection fixation of the aforementioned valve element 132 as shown in drawing 4 is arranged in the solenoid housing 131 interior, and this plunger 133 is supported free [sliding] by the pipe 136 which touches a close state through O ring 134a at the edge of the aforementioned control valve main part 120. the hold formed in the back end section of a plunger 133 -- while insertion fixation of the upper-limit section 138a of a stem 138 is carried out at a hole 137 -- soffit section 138b of the aforementioned stem 138 -- front end section hold of the suction child 141 -- the back end section hold from a hole 142 side -- it is in the state projected to a hole 143 side, and is supported free [sliding] to the suction child 141 front end section hold of the aforementioned plunger 133 and the aforementioned suction child 141 -- between holes 142, the valve-opening spring 144 energized in the direction which separates a plunger 133 from the suction child 141 side is formed
[0036] moreover, a stopper 147 side equips soffit section 138b of a stem 138 free [attachment and detachment] among the stoppers 147,148 of the couple of the bellows 146 interior arranged in pressure-sensitive room 145a -- having -- the back end section hold by the side of the flange 149 of this stopper 147, and the aforementioned suction child 141 -- between holes 143, the spring 150 energized in the direction which separates a stopper 147 from the suction child 141 side is formed the suction pressure Ps in pressure-sensitive room 145a becomes high, and stopper 147,148 comrades of a couple contact by contraction of bellows 146 -- the variation rate of bellows 146 -- a position regulates -- having -- this maximum -- a variation rate -- an amount is set up so that it may become smaller than the amount of the maximum fitting of soffit section 138b of the aforementioned stem 138, and the stopper 147 of bellows 146 In addition, the code 158 which can supply the exciting current controlled by the control computer (illustration ellipsis) is connected to aforementioned solenoid 131A (drawing 3).
[0037] Next, an operation with the variable-capacity type compressor 1 of this operation gestalt and a control valve 100 is explained. The rotational-motion force of a mounted engine is always transmitted to the aforementioned shaft 5 from a pulley (illustration ellipsis) through a belt (illustration ellipsis), and the turning effort of a shaft 5 is transmitted to a cam plate 10 through the thrust flange 40 and the hinge mechanism 41, and rotates this cam plate 10.
[0038] A shoe 50 carries out relative rotation of the sliding-surface 10a top of a cam plate 10 by rotation of a cam plate 10, it is changed into straight-line reciprocating movement of a piston 7, as a result, the capacity of the compression space 82 in a cylinder bore 6 changes, inhalation of a refrigerant gas, compression, and the regurgitation are performed one by one by this capacity change, and the refrigerant gas of capacity according to the degree of tilt angle of a cam plate 10 is breathed out. First, when a thermal load becomes large, the inflow of a refrigerant gas is prevented from the regurgitation room 12 by the crank case 8, the pressure of a crank case 8 is low, and the force produced in the rear side of the piston 7 in a compression stroke becomes

small, and when total of the force produced in the rear side of a piston 7 is less than total of the force produced in the front side (top side) of a piston 7, the degree of tilt angle of a cam plate 10 becomes large.

[0039] The pressure of the regurgitation room 12 becomes high and the pressure differential of the regurgitation room 12 and a crank case 8 becomes here beyond a predetermined value. When the pressure of the refrigerant gas of the regurgitation room 12 which acts on the spool-type-valve 31 bottom overcomes the pressure of the refrigerant gas of a crank case 8 which acts on the spool-type-valve 31 bottom, and resultant force of the energization force of a spring 32 A spool type valve 31 moves in the valve-opening direction, the regurgitation path 39 opens (drawing 1), and the refrigerant gas of the regurgitation room 12 flows out of delivery 1a into a capacitor 88. In addition, since boss section 10b of a cam plate 10 separates from hole 58c of a ring 9, the first path 58 is opened fully and the refrigerant gas of a crank case 8 flows to an inhalatorium through the first path 58 when the degree of tilt angle of a cam plate 10 becomes the maximum from the minimum, the failure of pressure of a crank case 8 happens. Moreover, if the path area of the first path 58 becomes the maximum, in an inhalatorium 13, a refrigerant gas will hardly flow from the third path 60.

[0040] Thus, when a thermal load becomes large and solenoid 131A of a control valve 100 is excited, a plunger 133 is drawn in the suction child 141 side, it moves in the direction in which the valve element 132 connected with the plunger 133 closes a valve port 125, and the inflow of a crank case 8 is prevented. On the other hand, a low-temperature refrigerant gas is led to a pressure-sensitive part 145 through the inhalation refrigerant port 129 of the control valve main part 120, and plunger room 130a from the path 80 side which is open for free passage to an inhalatorium 13, the bellows 146 of a pressure-sensitive part 145 is displaced based on the pressure of the aforementioned refrigerant gas which is the suction pressure Ps of an inhalatorium 13, and this displacement is transmitted to the aforementioned valve element 132 through the aforementioned stem 138 and the aforementioned plunger 133. That is, the opening position to the aforementioned valve port 125 of the aforementioned valve element 132 is determined by the suction force by the aforementioned solenoid 131A, the energization force of the aforementioned bellows 146, and the energization force of the aforementioned valve-closing spring 127 and the valve-opening spring 144.

[0041] And if the pressure in the aforementioned pressure-sensitive room 145a (suction pressure Ps) becomes high, since the aforementioned bellows 146 contracts and this is in agreement with the suction direction of the aforementioned plunger 133 by the aforementioned solenoid 131A, movement of the aforementioned valve element 132 follows the variation rate of bellows 146, and the opening of the aforementioned valve port 125 decreases. Thereby, the amount of the high-pressure refrigerant gas drawn in the valve chest 123 from the regurgitation room 12 decreases (the crank case pressure Pc declines), and the degree of tilt angle of a cam plate 10 increases it (drawing 1). Moreover, if the pressure in the aforementioned pressure-sensitive room 145a becomes low, it will elongate according to the stability of spring 159 and bellows 146 self, the aforementioned bellows 146 will move in the direction in which a valve element 132 increases the opening of a valve port 125, the amount of the high-pressure refrigerant gas drawn in the valve chest 123 will increase (the crank case pressure Pc increases), and the degree of tilt angle of the cam plate 10 in the state of drawing 1 will decrease.

[0042] On the other hand, when a thermal load becomes small, a high-pressure refrigerant gas flows out of the regurgitation room 12 into a crank case 8, and the pressure of this crank case 8 becomes high. And the force produced in the rear side of the piston 7 in a compression stroke becomes large, and when total of the force produced in the rear side of a piston 7 exceeds total of the force produced in the front side of a piston 7, the degree of tilt angle of a cam plate 10 becomes small.

[0043] Here, the pressure differential of the aforementioned **** room 12 and a crank case 8 becomes below a predetermined value, when resultant force with the pressure of a crank case 8 and the energization force of a spring 32 of acting on the spool-type-valve 31 bottom overcomes the pressure of the refrigerant gas of the **** room 12 which acts on the spool-

type-valve 31 bottom, a spool type valve 31 moves in the valve-closing direction, the **** path 39 is intercepted (drawing 2), and the outflow of the refrigerant gas to a capacitor 88 is prevented from delivery 1a. in addition -- the time of the degree of tilt angle of a cam plate 10 serving as the minimum from the maximum -- boss section 10b of a cam plate 10 -- the hole of a ring 9 -- although 58c is closed mostly and the path cross section of the first path 58 is decreased sharply, since the refrigerant gas in a crank case 8 flows to an inhalatorium 13 through the third path 60, the overpressure rise in a crank case 8 is suppressed, and circulation of the refrigerant gas in a compressor 1 is attained That is, a refrigerant gas returns to an inhalatorium 13 again through an inhalatorium 13, compression space 82, the **** room 12, the second path 57, a crank case 8, and the third path 60 in this case. The pressure of a crank case 8 is made to act on one side of the spool type valve 31 as a **** control valve with this operation form. The structure of making the pressure of the **** room 12 acting is adopted as another side of a spool type valve 31. The spring 32 which has the comparatively small spring force energized in the valve-closing direction as a spool type valve 31 is used. A spool type valve 31 is maintained at the state where it opened until it becomes the minimum piston stroke (super-low load) and a cam plate 10 decreases the path area of the first path 58, when a thermal load becomes small and the pressure of the **** room 12 declines gradually.

[0044] Thus, when a thermal load becomes small and the aforementioned solenoid 131A is demagnetized, suction to a plunger 133 disappears, it moves in the direction in which the aforementioned plunger 133 separates from the aforementioned suction child 141 side according to the energization force of the aforementioned valve-opening spring 144, a valve element 132 moves in the direction which opens the valve port 125 of the control valve main part 120, and the inflow to a crank case 8 is promoted. Here, if the pressure in the aforementioned pressure-sensitive part 145 rises, although the aforementioned bellows 146 will contract and the opening of a valve element 132 will decrease, since it is equipped with soffit section 138b of the aforementioned stem 138 free [attachment and detachment] to the stopper 147 of the aforementioned bellows 146, the variation rate of the aforementioned bellows 146 does not affect it to a valve element 132.

[0045] The solenoid excitation section 130 to which the control valve 100 of this operation gestalt equipped the center section with the plunger 133 which moves in the vertical direction by excitation of solenoid 131A as mentioned above, The pressure-sensitive part 145 which arranged the bellows 146 interlocked with a plunger 133 through stem 138 grade at this solenoid excitation section 130 bottom, Since it is formed with the control valve main part 120 which has the valve chest 123 which arranged in the aforementioned solenoid housing 131 bottom the valve element 132 grade interlocked with a plunger 133, Approach arrangement of pressure-sensitive room 145a and the solenoid 131A can be carried out, the point of application by suction of solenoid 131A and the point of application by bellows 146 can approach, and it can hold down with [at the time of movement in the valve-closing direction of the valve element 132 and stem 138 which constitute an operation lever] backlash to necessary minimum.

[0046] While it has the pressure room 151 of the closed-end longitudinal hole of the same cross section as a valve port 125 and this pressure room 151 and the opening section 139 are open for free passage with a side hole 153, a stopper 124 the aforementioned opening section 139 and plunger room 130a -- cancellation -- since it is open for free passage with the hole 155, the pressure of plunger room 130a of the control valve main part 120 and the pressure of the pressure room 151 turn into both the suction pressure Ps, and the pressure in the vertical edge of the movable direction of a valve element 132 always becomes equal Therefore, with this operation gestalt, balance can always be maintained in the valve element 132 upper and lower sides by the change in the crank case pressure Pc to the force of acting on a valve element changing and the balance of the valve element upper and lower sides changing like [in the case of making the valve element upper and lower sides of the aforementioned conventional example into the crank case pressure Pc]. Moreover, when the maximum discharging volume operation of a compressor 1 is performed, a valve element 132 is strongly forced to valve seat 125a by the discharge pressure Pd, and supply of a refrigerant gas to the second path 57 of a compressor 1 can prevent a bird clapper difficult by it. For this reason, similarly the opening of a valve port 125

is controllable to the same current value.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing of longitudinal section showing the state where the regurgitation path of the variable-capacity compressor equipped with the control valve of 1 operation gestalt of this invention opened.
[Drawing 2] Drawing of longitudinal section showing the state where the regurgitation path of the variable-capacity compressor of drawing 1 closed.
[Drawing 3] The enlarged vertical longitudinal sectional view of the control valve for the variable-capacity type compressors of drawing 1 .
[Drawing 4] Drawing of longitudinal section showing the detail of the control valve for the variable-capacity type compressors of drawing 3 .
[Drawing 5] Drawing of longitudinal section made to rotate 90 degrees of control valves for the variable-capacity type compressors of drawing 4 .
[Drawing 6] Drawing of longitudinal section showing the variable-capacity type compressor equipped with the conventional control valve.
[Drawing 7] Drawing of longitudinal section showing the detail of the control valve for variable-capacity type compressors of drawing 6 .
[Description of Notations]
1 Variable-Capacity Type Compressor
8 Crank Case
100 Control Valve for Variable-Capacity Type Compressors
120 Control Valve Main Part
123 Valve Chest
124 Stopper
125 Valve Port
126 Regurgitation Refrigerant Port
127 Valve-Closing Spring
128 Crank Case Refrigerant Port
129 Inhalation Refrigerant Port
130 Solenoid Excitation Section
130a Plunger room
132 Valve Element
132a Upper part
132b Expansion valve element section
132c Thin diameter section
132d Lower part
133 Plunger
145 Pressure-sensitive Part
151 Pressure Room
155 Cancellation -- Hole

[Translation done.]

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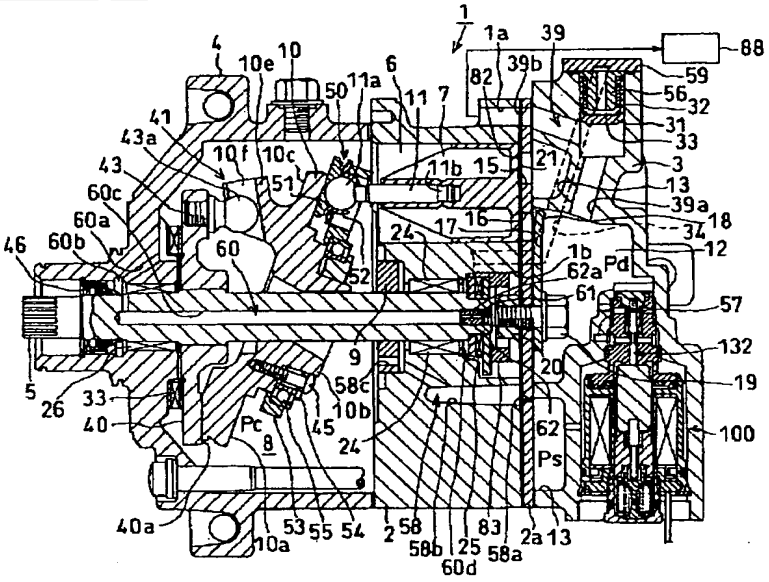
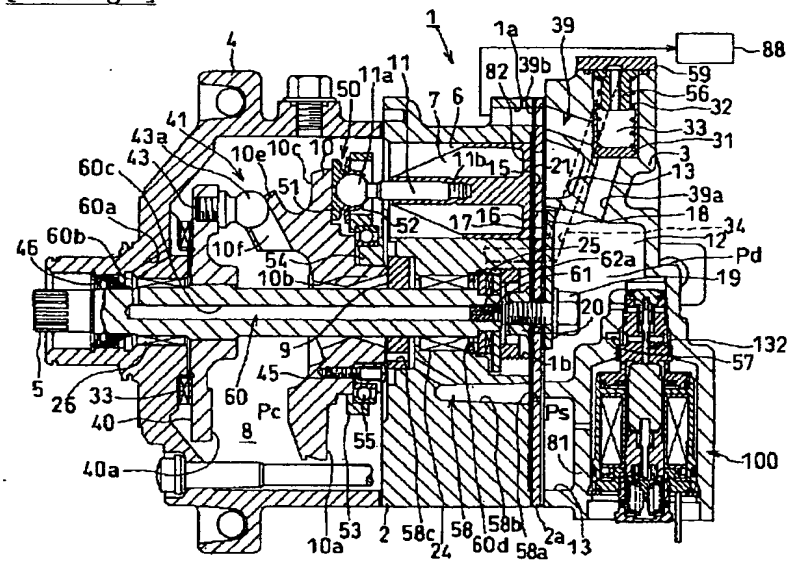
DRAWINGS

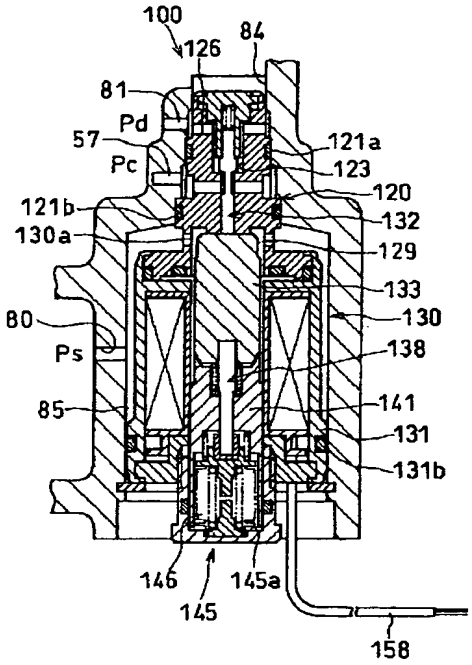
[Drawing 1]



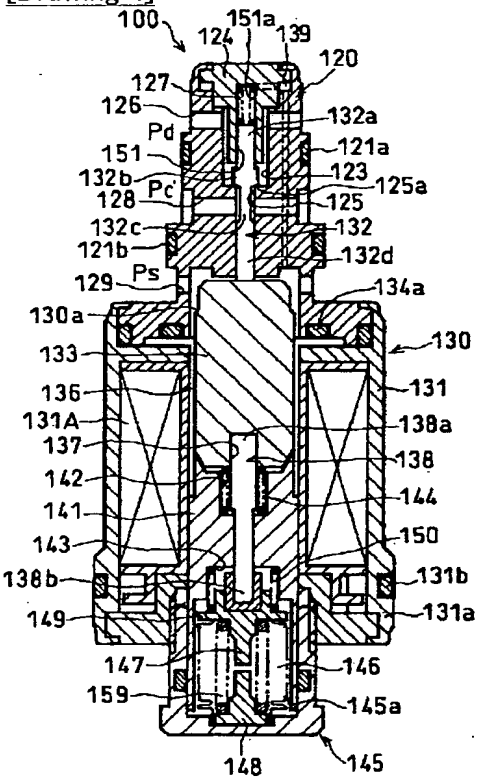
[Drawing 2]



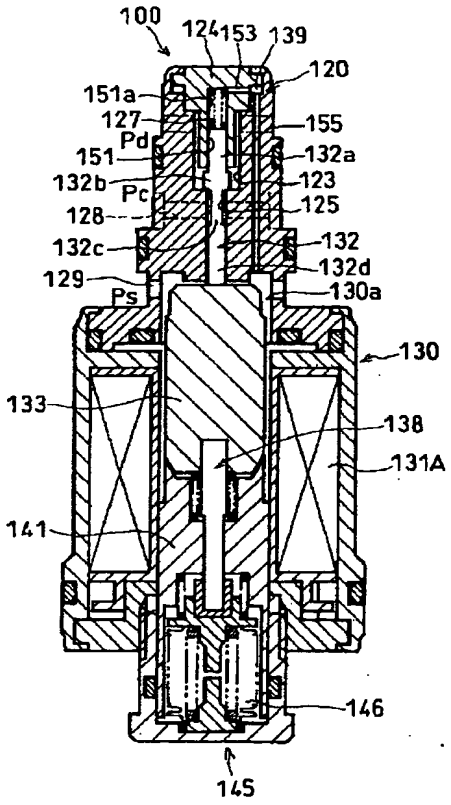
[Drawing 3]



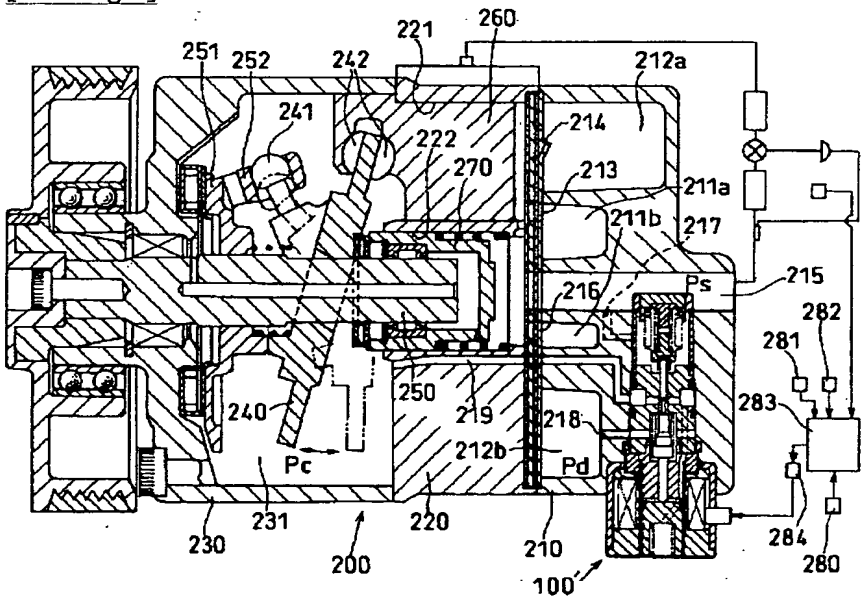
[Drawing 4]



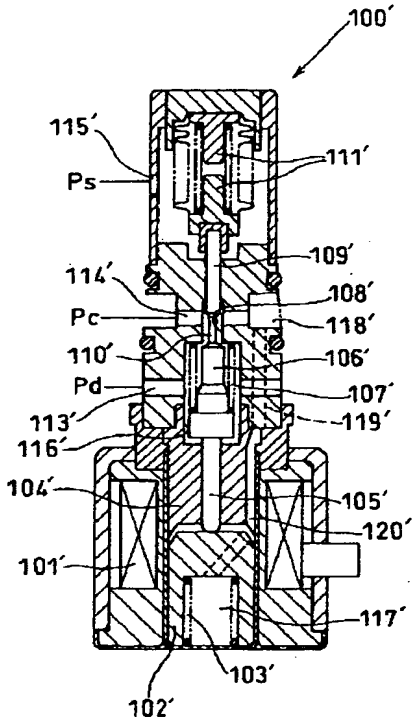
[Drawing 5]



[Drawing 6]



[Drawing 7]



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